

3.0 Analysis of High Crash Intersections

The intersections identified as high crash locations were studied individually using the following procedures.

1. Identification of crash patterns through the development and analysis of collision diagrams.
2. Discernment of the possible causes of crashes utilizing turning movement counts, striping plans, construction history, signal timings, and field observations.
3. Feasibility testing of possible countermeasures and safety improvements.
4. Evaluation of the costs and adverse impacts of countermeasures on the prevailing intersection conditions.

Technical Appendix Volume 1 contains a detailed inventory of intersection characteristics for 2003. The inventory of intersection characteristics for 2004 is included in Technical Appendix Volume 2. These include collision diagrams, striping plans, turning movement counts, lane configurations, photo inventories, and crash summaries by various factors such as, time of day, day of week, and road conditions. Tables are also included that detail crash patterns and possible countermeasures.

3.1 Economic Analysis

After each of the intersections was studied and countermeasures were screened according to the above procedures, the recommended countermeasures were evaluated economically. This was done to determine which countermeasures are economically justified and which provide the best possible investment. An interest rate of 6% was used when calculating the P/F and A/P factors for both study years, after reviewing the current economic indicators and interest rates in the state.

3.1.1 Reduction Factors

To determine the best possible investments, the effectiveness of each countermeasure must be evaluated. This is done through the use of crash reduction factors. The reduction factors used for this study can be seen in **Table 7**. This table has been prepared using “before and after” studies conducted by the City of Lincoln, Traffic Engineering Division. This table also includes the service life of each improvement with their corresponding initial cost of implementation.

3.1.2 Benefit-Cost Analysis

To determine countermeasures that both reduce the number of crashes and are cost effective, a benefit-cost analysis must be performed. To accomplish this, all crash patterns and countermeasures were listed for each intersection studied. Reduction factors for each pattern and countermeasure were then applied.

To obtain the benefit-cost ratio, procedures outlined in the Institute of Transportation Engineers (ITE) *Selecting and Making Highway Safety Improvements* were followed. However, for the purpose of this report, some modifications were made to those

specified. The methods used for this report are included in Technical Appendix B and E for the years 2003 and 2004 respectively.

Table 7 – Crash Reduction Factors

			Percent Reduction By Type					Service Life (yrs)	Average Initial Cost	
			Rear End	Right Angle	Left Turn	Right Turn	Fixed Object			
Type of Improvement										
Markings	Crosswalk		20					3	\$1000	
	Arrow’s and Only’s				50	50		3	\$250	
	Stop Bars			50				3	\$100	
	Left Turn Offset				40			3	\$500	
	Solid Line and Gore Area		50					3	\$500	
Signs	Advisory				20			6	\$100	
	Warning		10	20			10	6	\$100	
	Regulatory			50				6	\$100	
	Variable Message (LED)				10	10		10	\$4,000	
Other	Sight Hazard			20				1	\$100	
	Speed Limit		10	10				6	\$100	
Traffic Signals	New	Intersection Traffic Signal		*	80	*			15	\$100,000
		Intersection Flashing Beacon		10	50				10	\$20,000
		Advance Flashing Beacon		20	20				10	\$4,000
	Modifications	Red LED Signal Indications		10	30				10	\$500
		Add Signal Head		10	30				15	\$2,000
		Add Pole Mount Signal Head		10	10				15	\$2,000
		Install Mast Arm (one direction)		10	30				15	\$10,000
		Shift Signal Head Alignment		10	10				15	\$300
		Protected Right Turn Signal		50	10		50		15	\$5,000
		Add Protected/Permissive Left Turn Phase				50			15	\$7,500
		Remove Permissive Left Turn Phase (Protected Only)				50			5	\$5,000
		Yellow Clearance Interval		10					1	\$250
		All Red Interval			10				1	\$250
		Progression		10	10				1	\$1000
Geometrics	Major	Intersection Widening	W/ Concrete Medians	50		70			20	Cost Calculated for Individual Project
			W/Painted Medians							
		Approach Widening	Provide Left Turn Lane	50		70			20	
			Provide Right Turn Lane							
			Provide Through Lane							
	Install Roundabout			75	75		75			
	Minor	Concrete Median to Prohibit Movements			50				10	
		Remove Median	Provide Left Turn Lane	50	80	50			10	
Provide Realignment										

Source: Factors estimated from "Before and After" Studies conducted by the City of Lincoln, NE Traffic Engineering Division

*Studies have shown these crash patterns will increase with the installation of a new traffic signal.